NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF THE BUILT ENVIRONMENT

DEPARTMENT OF CONSTRUCTION MANAGEMENT/QUANTITY SURVEYING

CONSTRUCTION EQUIPMENT AND METHODS

BQS4108

Main Examination Paper

December 2024

This examination paper consists of **six (6)** pages.

Time Allowed:	**3 Hours**
Total Marks	**100**
Special Requirements	**None**
Examiner's Name:	**Ms. F. Charumbira**

INSTRUCTIONS

1. Answer **any four (4)** questions.

MARK ALLOCATION

QUESTION	MARKS
1	25
2	25
3	25
4	25
5	25
TOTAL	**100**

Question One

a) ABC Limited is considering purchasing an excavator. Using the Equivalent Annual Cost, advise the firm on the better equipment to purchase.

Machine A has the following:

An initial capital outlay of $105,000

An expected lifespan of three years

An annual maintenance expense of $11,000

Machine B has the following:

An initial capital outlay of $175,000

An expected lifespan of five years

An annual maintenance expense of $8,500

The cost of capital for the company making the decision is 5%. [10 marks]

b) June Construction is considering the purchase of a pedestrian roller at a cost of $10,500, with an estimated salvage value of $500 and a projected useful life of four years. Determine the yearly ownership cost using:

I. straight-line method (SL), [5 marks]

II. sum of years method (SOY), [5 marks]

III. double declining balance methods of depreciation [5 marks]

[25 marks]

Question Two

a) Ajay Limited has appointed you as the lead consultant in the planning of a bridge construction project which shall commence in April 2025. A meeting with the sponsors shall be held on the 20th of December 2024 and you have been tasked with presenting a program of works for the project. Given information on **Table A** below

I. Draw a network diagram to represent the inter-relationships between the activities indicated. [7 marks]

II. Determine the critical activities and duration of the project. [6 marks]

b) Based on the duration of the project, advise the sponsors on the most appropriate method of acquiring equipment for the project. [12 marks]

[25 marks]

TABLE A

ACTIVITY	TIME IN WEEKS	ACTIVITY	TIME IN WEEKS
1-2	4	5-7	8
1-3	1	6-8	1
2-4	1	7-8	2
3-4	1	8-9	1
3-5	6	8-10	8
4-9	5	9-10	7
5-6	4		

Question Three

a) JJ Contractors have been awarded a tender for the construction of a 3km long x 7m wide road. Using information in **APPENDIX A**, produce a method statement for the works, paying attention to equipment to be used and its purpose.

[25 marks]

Question Four

Sabin Construction has been nominated for the construction of a 1200m long by 800m wide car park. The car park shall be constructed using 150mm thick reinforced grade 30 concrete on a former dump site which requires excavations 500mm deep to remove the overburden. Advise the project manager on the extent of mechanization and the equipment to be used for the project given that the project site is located in an area with labour unrest and strikes.

[25 marks]

Question Five

a) Determine the probable cost per hour of owning and operating a 25-ton tipper truck with six rubber tyres using the following information:

- Diesel Engine 250 hp.
- Crankcase capacity 14 litres
- Time between oil changes 80 hr
- Operating factor 60 %
- Useful life 5 years, with no salvage value
- Life of tyres 5,000 hrs
- Repair of tires 15% of tire depreciation
- Cost delivered including freight and taxes = $ 92,623
- Cost of tires =$ 12,113
- Maintenance = 50% of Depreciation
- Hours operated per year = 2000hrs
- Investment rate = 15%
- Cost of diesel per litre $1,48
- Cost of oil per litre $3,80

[25 marks]

APPENDIX A: JJ Contractors BOQ

Item	Description	Unit	Quantity	Rate	Amount
	Preliminaries and generals	Sum	1		
	1. Bush Clearing				
1,1	Contractor to clear the area of construction of all rock proud of natural level, rubbish, debris, grass, bushes, undergrowth, hedges and trees and stumps of all sizes, including grubbing up roots and filling in holes and roughly levelling and preparing for building upon.	m^2	21 000,00		
	2. Earth Works				
2,1	Stockpile, Load and haul approved gravel from borrow pits	m^3	9000,00		
2,2	Spread, water, mix and compact 150mm thick subgrade to 90% Mod AASHTHO	m^3	3000,00		
2,3	Spread, water, mix and compact 150mm thick Base 1 to 98% Mod AASHTHO	m^3	3000,00		
2,4	Side drain formation	m	4000,00		
	2. Surfacing				
2,1	Supply and apply MC30 prime at 1L/m^2 to base surface	litres	2 1000,00		
2,2	a) Supply and apply bitumen binder for tack coat@ 1.2L/m^2 including	litres	2 5200,00		
2,3	b) Supply and apply 19mm aggregate stone at 0.013cum/sq.m for tack coat	m^3	260,00		
2,4	a)Supply and apply 70/100 pen grade bitumen binder for seal coat@ 1L/m^2	litres	2 1000,00		
2,5	b) Supply and apply 7mm aggregate stone at 0.007cu.m/sq.m for seal coat	m^3	140,00		
2,6	Allow for sweeping after surfacing	m^2	21 000,00		
	TOTAL CARRIED TO SUMMARY				-

END OF EXAMINATION